AD NUMBER

AD479198

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 01 MAY 1952. Other requests shall be referred to Naval School of Aviation Medicine, Pensacola NAS, FL.

AUTHORITY

usnamrl ltr 11 may 1971

U. S. NAVAL SCHOOL OF AVIATION MEDICINE
NAVAL AIR STATION
PENSACOLA, FLORIDA

(6) STUDIES OF AIRCRAFT ACCIDENTS INVOLVING OFFICER TRAINEES IN THE BASIC TRAINING COMMAND FOR FISCAL 1951.

Part I.

A Study of the Statistical Significance of the Number of Aircraft Accidents by Officer Trainees in Relation to their Proportional Representation in the Training Population.

(9) Special Report, [redacted] ALL DDC [illegible]

By

(10) William F. Madden, LCDR, MSC, USN

Approved By

Captain Ashton Graybiel, MC, USN
Director of Research

Released By

Captain Leon D. Carson, MC, USN
Commanding Officer

(11) 1 May 1952, (12) 14

SUMMARY

Problem: At the request of the Basic Training Command, a study was made of the accident rates by officer trainees and NavCads for the fiscal year of 1951.

Findings: When compared with their expected accident rate, the difference between this expectancy and the actual number of accidents occurring each month, the difference was not statistically significant. On a yearly basis, however, it was found that the student officers did have a proportionately higher accident rate in comparison with NavCads.

Indications were found in the data to question the statement by the Pilot Caused Accident Committee discussion to the affect that student officers do meet the same flight proficiency standards. During fiscal 1951 there were six monthly periods in which no officers were attrited. The student officers exceeded their accident expectancy during four of these months while they exceeded their rate in but two of the six months when there were some officer attritions. Further, it was found that of those officers and NavCads having accidents, no officers were attrited whereas seven (10%) NavCads were attrited.

Recommendations: A system of plotting accident rates against their expectancy rate is recommended as a method of analysis of future accident trends.

On 1 May 1951 the Chief of Naval Air Basic Training forwarded to the Commanding Officer, NavSchAvMed, a request that the Psychology Laboratory of the Research Department conduct a study of the difference in the accident rate between officer students and NavCads, to find the reasons therefore, if possible, and to make appropriate recommendations. This basic correspondence and tables containing statistical data are listed in the Appendix of this report.

The facts which gave rise to the basic request may be summarized as follows:

1. That during the period between 1 July 1950 and 28 February 1951, although the officer students represented 22.8% of the student load on board, they were responsible for 40.3% of the accidents.

2. That the attrition rate for officers was lower than among NavCads. These facts suggested the necessity for answering the following specific questions.

(a) Is the difference in accident rate between the two groups of statistical significance or a matter of chance?

(b) If the difference is of statistical significance:

(1) What reasons can be advanced to explain the difference?
(2) What suggestions can be made for administrative considerations?

PROCEDURE

1. Collection of data:

a. Records were assembled of NavCad and student officers in basic flight training for fiscal 1951. (Excluding students in pre-flight, special syllabus and advanced syllabus students in CQTU-4).

2. Analysis of data:

a. Tables and a graph were prepared to show monthly accident experience of each group for purposes of comparison.

b. A statistical analysis was made to determine significance of the monthly and total years accidents experience by the Chi-square technique. To do this the accident expectancy and actual accident experience were used as the basis for computation

RESULTS

Table I presents the number of subject trainees on board each month during fiscal 1951 who were training under the standard syllabus. The

monthly average for the year was 833.[1] On the average about 30% of these students were officers.

Table II presents the number of accidents sustained by the groups included in Table I. It will be noted that there were 112 accidents, of which 41 involved officers, 71 NavCads. Percentage wise this means that on the average 37% of the accidents involved officers, 63% involved NavCads.

Table III compares, by months, the number of accidents to be expected and the number actually sustained by student officers during fiscal 1951.[2]

These month to month differences are not statistically significant, although the occasionally high number of accidents in anyone month appear to be cause for concern at first glance. Caution is necessary in drawing conclusions from any such small sample, for the chances are relatively slight that student officers will exceed their "share" of accidents in any one month. This need for caution applies also, of course, to the fact that months in which fewer than usual accidents occur offer no ground for complacence.

Considered on a yearly basis, it is very probable that student officers will exceed their expected accident rate to at least a slight extent. Moreover, again on a yearly basis, it is almost certain that the student officers will have an accident rate proportionately higher than the NavCad rate.[3]

DISCUSSION

The meager knowledge we have concerning the basic causes of accidents permits drawing only very tenuous generalizations from such data as have been studied here. Accident causation is no simple problem, and may well be rooted in some complex manner in basic processes of individuals' adaptation to social (as well as physical) environments. It is now almost common knowledge that a worried individual is more likely to have an accident. Individuals vary, not only in the kind and amount of worrying they do, but also in the extent to which worry makes them accident prone.

1. This average is less than the average supplied in the basic correspondence because it was necessary to eliminate those men in the on-board population who were not training under the standard flight syllabus.

2. The number of accidents to be "expected" is calculated simply by assuming that the number of accidents sustained by either the student officer of NavCad groups should be in proportion to the number of students flying in each group.

3. These estimates are based on figures derived by the Chi-Square test for statistical significance. The levels of confidence derived were as follows;

a. Officer accidents compared with their expected monthly rate = .10
b. Officer accidents compared with their expected annual rate = .05
c. Officer accidents compared with NavCads accidents for fiscal 1951 = .01

Although the present statistical analysis is not cause for alarm (that is, the difference between student officer and NavCad accident experience is not greatly more than might be due to chance) there is a definite trend which suggests the need for careful investigation.

One variable of possible importance included in the basic correspondence was reference to the fact that relatively few student officers attrite for reasons of flight failure. Accordingly, the files on this group were examined and the data are presented in Table IV. It will be seen that officers represent only 12% of the flight failure attritions. Perhaps even more interesting is Plate I, which combines in graphic form the accident figures from Table III and the attrition data from Table IV. From this graph it may be seen that the officers exceeded their expected accident rate during 4 of the 6 months in which no officers were attrited for flight failure and in but 2 of the 6 months when there were some officer attritions.

Pursuing the trend suggested by the above data Table V was prepared, which shows that 41 officer trainees and 71 NavCads survived accidents during the period covered by this study. None of officers in this accident group were attrited for flight failure, while seven of the NavCads were attrited.

These data suggest the fact that the statements in the basic correspondence which report that the NavCads and officer trainees meet the same standards for instruction (and therefore attrition) are open to question. However, the above data is merely suggestive and no firm conclusion can be drawn because there are other factors which might be operative in this situation such as:

1. Different ages and experience of the two groups.
2. The relative seriousness of the accidents involved.
3. Different living conditions and personal responsibilities of the two groups.
4. Stages of training in which the accidents occur.

Such factors should be investigated, and it is intended that they shall be made the subject of succeeding reports in this series.

RECOMMENDATIONS

On the basis of the data available on the accident rate and attrition rate of officer trainees it is recommended that monthly reports on these variables be presented together when the problem of accident analysis is up for discussion. It is further recommended that the Safety Officer or other appropriate official keep a running graph similar to that presented in Plate I for the various types of trainee. In this way the expected frequency of accidents can at all times be considered in relation to the actual number of accidents. If it is found that either officer trainees or NavCads begin to exceed their accident expectancy, the matter should be brought to the attention of the proper officials for detailed analysis. A practical criterion for implementing such a special investigation might be the occurrance of accidents in excess of expectancy for two consecutive months.

TABLE I

NUMBER OF TRAINEES ADJUSTED TO INCLUDE ONLY AMERICAN FLIGHT TRAINEES IN ACTUAL FLIGHT TRAINING AND ENROLLED IN THE STANDARD SYLLABUS DURING FISCAL 1951*

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Av.
No. Officers	297	270	274	270	248	250	233	225	209	218	219	231	245.3
No. NavCads	590	628	627	545	449	493	474	525	577	639	705	752	583.6
Total Trainees	887	898	901	815	747	743	707	750	786	857	924	983	833.1
% Officers	33.5	30.1	30.4	33.1	33.2	33.6	33.0	30.0	26.6	25.4	23.7	23.5	29.6
% NavCads	66.5	69.9	69.6	66.9	66.8	66.4	67.0	70.0	73.4	74.6	76.3	76.5	70.3
Total %	100	100	100	100	100	100	100	100	100	100	100	100	100

* These adjusted figures were procured from the CNATRA Annual Report for Fiscal 1951.

TABLE II

NUMBER OF ACCIDENTS SUSTAINED BY OFFICER TRAINEES AND NAVCADS IN THE BASIC TRAINING COMMAND, FISCAL 1951

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
No. Officer Accidents	1	2	0	6	2	5	4	10	6	2	3	0	41
No. NavCad Accidents	2	5	9	8	6	2	4	9	4	8	8	6	71
Total	3	7	9	14	8	7	8	19	10	10	11	6	112
% Officer Accidents	33.0	29.0	00.0	43.0	25.0	71.0	50.0	53.0	60.0	20.0	27.0	00.0	37.0
% NavCad Accidents	67.0	71.0	100	57.0	75.0	29.0	50.0	47.0	40.0	80.0	73.0	100	63.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE XII

COMPARISON OF NUMBER OF ACCIDENTS EXPECTED TO BE SUSTAINED BY STUDENT OFFICERS DURING FISCAL 1951 AND THE NUMBER ACTUALLY SUSTAINED

Month	Expected Accidents	Actual Accidents	Difference
July	1.00	1.00	
August	2.11	2.00	.11
September	2.74	0.00	2.74
October	4.63	6.00	-1.37
November	2.66	2.00	.66
December	2.35	5.00	-2.65
January	2.64	4.00	-1.36
February	5.70	10.00	-4.30
March	2.66	6.00	-3.34
April	2.54	2.00	.54
May	2.61	3.00	- .39
June	1.41	0.00	1.41

* For the statistically minded reader, the figures in column one were derived by multiplying the number of accidents occuring during each month (line 3, table 2) by the percent of student officers in the training population (line 4, table 1).

TABLE 'V'

PERCENT ATTRITION OF OFFICERS AND NAVCADS
BY REASON OF FLIGHT FAILURE

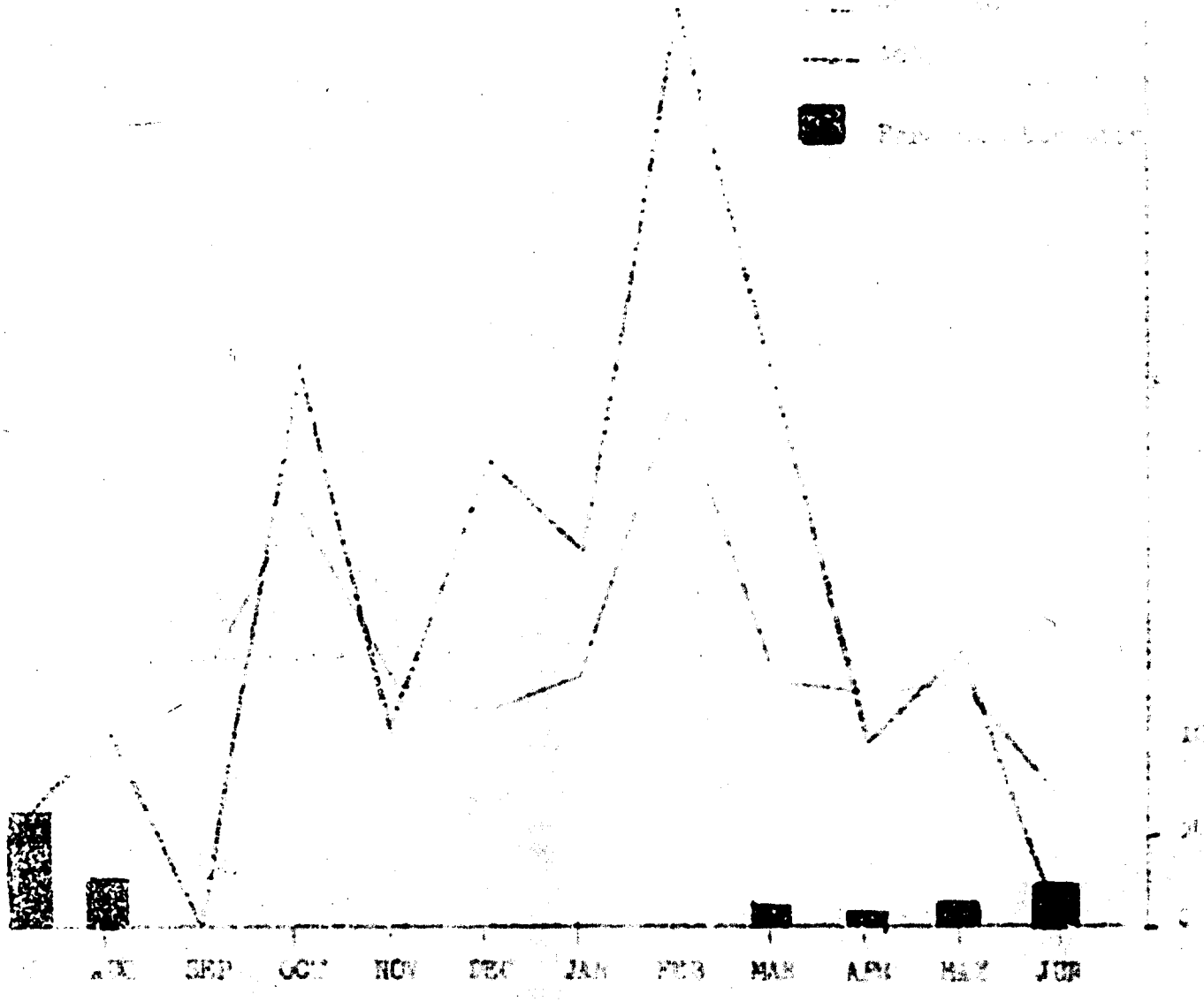
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	Av.
No.Officer Fl.Failures	3	3	0	0	0	0	0	0	1	1	2	3	13	1.08
No.NavCad Fl.Failures	2	10	7	10	10	9	1	8	8	10	14	10	99	8.25
Total	5	13	7	10	10	9	1	8	9	11	16	13	112	9.33
% Officers	60.0	23.0	00.0	00.0	00.0	00.0	00.0	00.0	11.0	09.0	13.0	23.0	12.0	12.0
% NavCads	40.0	77.0	100	100	100	100	100	100	89.0	91.0	87.0	77.0	88.0	88.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

TABLE V

OFFICERS AND NAVCADS WHO SURVIVED ACCIDENTS
AND WERE ATTRITED FOR REASONS OF FLIGHT FAILURE[1]

	Number Accidents	Percent Accidents	Number Attrited for Flight Failure Because of Accident	Percent Attrition
Officers	41	36.6	0	0
Cadets	71	63.4	7	100.0
Total	112	100.0	7	100.0

1. The basis for these figures rested on the assumption that if the trainee had not been attrited in a three month period after the accident, he had successfully passed the Flight Board convened at the time of the accident.



Best Available Copy

APPENDIX

BTO:HH:lab

1 May 1951

MEMORANDUM

To: Officer in Charge, Naval School of Aviation Medicine

Subj: Research Facilities; request for

Encl: (1) Copy of memo from Basic Safety Officer to BTO of 7 Mar 1951
(2) " " " " " " " " " " 12 " 1951
(3) " " " " " " " " " " 19 " 1951
(4) Excerpt from PCAC Minutes of 13 Mar 1951
(5) " " Safety Council Minutes of 3 April 1951

1. For the past eight months, officer students have been involved in an unusually high percentage of the aircraft accidents occurring in the Basic Flight Training program.

2. The reason for the difference in the accident rate between cadets and officer students is not readily apparent. Enclosures (1) and (2) present statistics which were prepared by the Basic Staff Safety Officer and which illustrate the higher accident rate of officer students. Enclosure (3) presents statistics on attrition rates for officer students and cadets. Enclosure (4) and enclosure (5) are excerpts from the minutes of the Pilot Caused Accident Committee and the Basic Safety Council, respectively, both of which have discussed the problem without coming to any definite conclusions. Enclosure (4) presents the opinion of the PCAC which holds that outside influences, not usually applicable to cadets, may be a contributing factor for the higher accident rate among officer students.

3. It is felt that officer students do meet the same flight standards as required of cadets, and therefore, any factors which may result in officer students, as a group, having a higher accident rate than cadets are outside of the flight and ground training which the students receive.

4. It is, therefore, requested that the Psychology Branch of the Research Laboratories of the School of Aviation Medicine conduct a study of the difference in the accident rate between cadets and officer students to determine, if possible, the reasons therefore and to make recommendations as are considered appropriate.

F. M. HUGHES
Rear Admiral, U.S. Navy
Chief of Naval Air Basic Training

Copy to:
CNATRA

COPY

BAS/PWS/gc

7 March 1951

MEMORANDUM

For: Basic Training Officer

Subj: Item for the Pilot Caused Accident Committee Agenda

1. It is interesting to note that officer students were involved in 18 or 62% of the total 29 accidents for the month, and further, that officer students were involved in 75% of the dual stall/spin and groundloop accidents. This is especially noteworthy since officer students comprise only 16% of the present total flight student complement. This situation is not just indicative of the February accident record, but seems to follow a general trend for the last seven months when officer students were involved in approximately 42% of the accidents. It cannot definitely be determined whether instructors are inclined to put more faith in officer students or whether officer students do not grasp the standardized ground and flight instruction in the same light as a cadet. In most cases the officer student is more mature and therefore might try to inject some of his own ideas, and in turn might lose some faith in his instructor. It is believed that officer students are not required to take the aviation aptitude tests which are required of the cadets prior to their acceptance in the program. One ex-instructor summed up his views in one short paragraph as follows: "Officer students are inclined to argue and alibi more than cadets." This may bear fruit for thought.

It is further noted that:

(a) The flight grades of officer students are higher than average. This is reasonable since they are normally more mature than the cadet.

(b) The attrition rate is lower. This is believed to stem from the fact that Student Pilot Disposition Boards are more lenient with officer students.

The low attrition rate against the high accident rate does not balance very well.

2. It is requested that chairman of the Pilot Caused Accident Committee place this student officer situation on the agenda of its next monthly meeting and also bring it to the attention of the Basic Safety Council.

P. W. SCHLEGEL

ENCLOSURE (1)

-2-

COPY

12 March 1951

MEMORANDUM FOR BASIC TRAINING OFFICER

Subj: Additional Accident Statistics on Student Officer Flight Training, forwarding of for item on Pilot Caused Accident Committee agenda

Encl: (1) Comparison of officer and cadet student load during period of 1 July 1950 to 28 February 1951
(2) Comparisan of officer and cadet student accident rates during period of 1 July 1950 to 28 February 1951

1. The following statistics are forwarded for inclusion on the agenda of the next monthly meeting of the Pilot Caused Accident Committee, and cover the period of 1 July 1950 through 28 February 1951. These statistics are based on all USN, USMC, USCG and USC&GS officer students in the Basic Training Command during the above period.

2. Highlights of these statistics are as follows:

a. Percent of officer students for the full period - 22.8

b. Percent of accidents involving officer students for full period - 40.3

c. Percent of officer students for period 7-1-50 through 12-31-50 - 24.7

d. Percent of accidents involving officer students for period 7-1-50 through 12-31-50 - 35.4

e. Percent of officer students for period 1-1-51 through 2-28-51 -18.0

f. Percent of accidents involving officer students for period 1-1-51 through 2-28-51 - 51.1

3. Enclosure (1) shows the percent of officer students against total Basic students broken down by weeks, months and full period. Enclosure (2) shows the accidents broken down into officer category, cadet/midshipman category and other category. The second enclosure also shows the percent of officer and cadet students involved in the accidents broken down into months.

4. These statistics were compiled from the NABT weekly statistical report (CNATRA 175-Rev. 1-51) and accident statistical records compiled in the CNABT Aviation Safety Officer.

Very respectfully,

P. W. SCHLEGEL

ENCLOSURE (2)

MONTH	1st WEEK	2nd WEEK	3rd WEEK	4th WEEK	TOTAL FOR MONTH
JULY	Officer 338 Total 1234 % Off. 26.9	Officer 340 Total 1238 % Off. 27.4	Officer 329 Total 1222 % Off. 26.9	Officer 327 Total 1219 % Off. 26.8	Officer 1328 Total 4913 % Off. 27.0
AUGUST	Officer 311 Total 1212 % Off. 25.7	Officer 321 Total 1218 % Off. 26.4	Officer 308 Total 1216 % Off. 25.3	Officer 307 Total 1196 % Off. 25.7	Officer 1247 Total 4844 % Off. 25.7
SEPTEMBER	Officer 327 Total 1248 % Off. 26.2	Officer 324 Total 1286 % Off. 25.2	Officer 340 Total 1289 % Off. 26.4	Officer 328 Total 1293 % Off. 25.4	Officer 1319 Total 5116 % Off. 25.8
OCTOBER	Officer 335 Total 1290 % Off. 26.0	Officer 318 Total 1280 % Off. 24.8	Officer 331 Total 1281 % Off. 25.8	Officer 327 Total 1342 % Off. 24.4	Officer 1311 Total 5193 % Off. 25.2
NOVEMBER	Officer 318 Total 1298 % Off. 24.5	Officer 303 Total 1316 % Off. 23.0	Officer 282 Total 1275 % Off. 22.1	Officer 280 Total 1306 % Off. 21.4	Officer 1183 Total 5195 % Off. 22.8
DECEMBER	Officer 283 Total 1298 % Off. 21.8	Officer 285 Total 1275 % Off. 22.4	Officer 256 Total 1217 % Off. 21.0	Officer 256 Total 1214 % Off. 21.1	Officer 1080 Total 5004 % Off. 21.6
JANUARY	Officer 248 Total 1298 % Off. 19.1	Officer 258 Total 1351 % Off. 19.4	Officer 256 Total 1370 % Off. 18.6	Officer 267 Total 1426 % Off. 18.7	Officer 1032 Total 5485 % Off. 18.8
FEBRUARY	Officer 271 Total 1505 % Off. 18.0	Officer 253 Total 1450 % Off. 17.5	Officer 253 Total 1530 % Off. 16.5	Officer 245 Total 1497 % Off. 16.4	Officer 1022 Total 5972 % Off. 17.1

JULY - FEBRUARY 22.8% Officers

JULY - DECEMBER 24.7% Officers

JANUARY - FEBRUARY 18.0% Officers

NOTE: The words "total on this page denote the total number of flight students in the command at that time. It includes officers, midshipmen, cadets, foreign and other.

ENCLOSURE (2)

UNIT	FOR ACC	STUDENT CONTROL ACCIDENTS TOT	PCT.	SOLO	PCT.	DUAL	PCT.	CIVILIAN/MIDSHIPMEN ACCIDENTS TOT	PCT	SOLO	PCT.	DUAL	PCT.	OTHER TOT	PCT.
[illegible]	[illegible]	[illegible]	20.8	[illegible]	[illegible]	0	--	5	38.5	4	30.8	1	7.7	4	30.8
[illegible]	21	6	28.6	6	28.6	0	--	11	52.4	11	52.4	0	--	4	19.1
[illegible]	18	2	11.1	2	11.1	0	--	12	66.7	8	44.4	4	22.2	4	22.2
[illegible]	16	8	50.0	6	[illegible]	2	12.5	8	50.0	6	31.3	2	18.8	0	--
[illegible]	20	10	50.0	10	[illegible]	0	--	10	50.0	9	45.0	1	5.0	0	--
[illegible]	11	6	45.5	5	[illegible]	1	9.1	5	[illegible]	5	54.6	0	--	0	--
[illegible]	16	7	43.8	6	37.5	1	6.3	6	37.5	3	18.8	3	18.8	3	18.8
[illegible]	29	16	55.2	10	[illegible]	6	20.7	10	[illegible]	8	27.6	2	6.9	3	10.3
TOTALS	164	89	40.3	68	33.3	10	6.9	87	47.2	54	37.5	14	9.7	18	12.5
[illegible]	99	35	35.4	32	32.3	3	3.0	52	52.5	43	43.4	9	9.1	12	12.1
[illegible]	45	23	51.1	16	35.6	7	15.6	16	35.5	11	24.4	5	11.1	6	13.3

C O P Y

19 March 1951

MEMORANDUM FOR CNABT TRAINING OFFICER

Subj: Student Pilot attrition rates, period 1 July 1950 through 28 February 1951

1.

	TOTAL ATTRITION	FLIGHT FAILURES	PHYSICAL DROPS LACK OF MOTIVATION DROP ON REQUEST OTHER
OFFICERS	19	5	14
MIDN/CADETS	114	60	54
TOTAL	133	65	68

2. Highlights of these statistics are as follows:

a. Percent of officer students for the full period - 22.8%

b. Percent of accidents involving officer students for full period - 40.3%

c. Percent of officer flight failures for full period - 7.7%

d. Percent of officer attrition for reasons other than flight failure - 20.6%

Respectfully,

P. W. SCHLEGEL

ENCLOSURE (3)

COPY

PILOT CAUSED ACCIDENT COMMITTEE DISCUSSION OF OFFICER ACCIDENT RATE AT MEETING OF 13 MARCH 1951

The Chairman read excerpts from a memorandum prepared by the Basic Safety Officer concerning accident statistics on student officers. The memorandum, in substance, brought out the following information: (1) that between 1 July 1950 and 28 February 1951 officer students comprised 22.8% of the student load and were involved in 40.3% of the Basic Training Command accidents, (2) that flight grades of student officers are higher than average, and the attrition rate for student officers is lower. The Safety Officer advanced the theory that the lower attrition rate may be caused by Student Pilot Disposition Boards being more lenient with student officers than with cadets. After discussion, the Committee was of the opinion that (1) student officers do meet the same flight proficiency standards required of cadets both on instruction flights and upon appearing before Student Pilot Disposition Boards, (2) that other factors, not usually applicable to cadets, such as marital problems, commuting difficulties and liberty every night, could possibly be a contributing factor for the higher accident rate. Further, it was considered that any action taken to restrict the recommendations of Student Pilot Disposition Boards would reduce their effectiveness and value to the CNABT. The committee recommended that the Training Officers, unit Officers-in-charge, and unit Safety Officers further investigate the student officer situation to see if any further action is deemed necessary.

ENCLOSURE (4)

COPY

SAFETY COUNCIL DISCUSSION OF OFFICER ACCIDENT RATE AT MEETING OF 3 APRIL 1951

DISCUSSION: The Chairman of the Pilot Caused Accident Committee read excerpts from a memorandum prepared by the Basic Safety Officer concerning accident statistics involving officer students. The memorandum, in substance, brought out the information that the flight grades of officer flight students were higher than average, and that the attrition rate of officer flight students was lower, but that for the period of 1 July 1950 through 28 February 1951 officer students were involved in 40.3% of the aircraft accidents even though they comprised only 22.8% of the flight student complement. The Basic Safety Officer advanced the theory that the lower attrition rate might be caused by Student Pilot Disposition Boards being more lenient with student officers than with cadets. The Pilot Caused Accident Committee was of the opinion that; (1) Student Officers do meet the same flight proficiency standards required of cadets both on instruction flights and upon appearing before Student Pilot Disposition Boards, (2) That other factors, not usually applicable to cadets, could possibly be contributing factors for the higher accident rate. Further, it was considered that any action taken to restrict the recommendations of the Student Pilot Disposition Boards would reduce their effectiveness and value to CNABT.

RECOMMENDATION: It was recommended that the student officer accident rate be further looked into.

ACTION: Commanding Officers, Training Officers, Unit Officers-in-Charge and Safety Officers further investigate the student officer situation to see what steps, if any, could be taken to reduce the accident rate. The Chairman of the Basic Safety Council reiterated his desire that commanding officers point out to the officer flight students that they were not only students, but their performance of duty as such will affect their careers, and that discrepancies will be reflected in their fitness reports. He felt that they should be instructed as to the importance of their fitness reports, and therefore should be concerned with their training habits.

ENCLOSURE (5)